

REMARKS

Claims 1-55 are pending in the application. In this Response, the Applicants have amended various pending claims and has canceled claims 4, 25-33, 42 and 45-54.

The Applicants submit that the remaining amended claims are in an allowable form and define over the cited art for the reasons set forth below.

INTERVIEW

The Applicants would like to thank the Examiner for his time and helpful suggestions during the Interview at the U.S. Patent and Trademark Office between the undersigned and the Examiner on July 6, 2005.

The Applicants have proceeded along the lines of those discussed to further clarify and define the invention as set forth in the pending claims and to clarify that invention with respect to the cited prior art. The Applicants submit that the claims are clear and precise and are not anticipated or rendered obvious by the current cited art of record. This Response is made to respond to the Final Office Action dated March 7, 2005. A Request for Continued Examination (RCE) is also enclosed herewith for consideration of the amended claims herein.

SECTION 103 REJECTIONS

All the claims are rejected under 35 U.S.C. §103 as being obvious based upon a combination of 2-4 separate references. After the amendments, independent claims 1, 16, 34 and 55 remain, and are discussed below.

The Applicant would like to first reiterate parts of the invention, as discussed in the Interview. Specifically, the embodiments of the inventions are directed to providing a plurality of service providers the ability to share an antenna system or a cellular tower. In so doing, the invention does not simply combine the RF signals in the RF realm as shown in Ke et al. Nor does the present invention as in Ke et al. take two providers operating in two different frequency bands, such as a CDMA band and a GSM band, and simply use RF combining techniques and put both of those frequency bands on the same antenna. Rather, the present invention is directed to utilizing an analog RF frequency band that contains the signals of two service providers to define multiple, individual beams for signals of the at least two individual service providers. Furthermore, the present invention converts the antenna signals associated with the beams between the analog communication frequency band and a common digital IF band that represents the signals of the at least two individual service providers in that common digital band. Digital filtering circuitry processes the digital IF band and defines individual portions of the digital IF bands such that a separate band portion is defined for signals of the at least two individual service providers. For example, in one embodiment, circuitry duplicates the common digital IF band and the digital filtering circuitry processes the digital IF band to define the individual portions of the respective digital IF bands. The invention then uses signal processing circuitry for each of the service providers that is operable to process the channel signals associated with the individual IF band portions defined for the service providers and to simultaneously drive the antenna to define at least one individual beam for each service provider.

Figure 3 discloses one particular embodiment of the invention wherein the common analog RF communication frequency band, which includes the signals of the plurality of service providers is converted to a common digital IF band. The digital IF band represents the signals of the plurality of service providers. Through a digital mux, as illustrated in Figure 3, the common digital IF band is duplicated to be provided to a plurality of band pass filters, where generally each of the service providers will have their own specific band pass circuitry. The digital IF band is passed through the plurality of the filtering circuit 76 to isolate and define individual portions of the digital IF band corresponding to the antenna signals of the individual service providers. As discussed on page 16 at the RF analog band, for example, 15 MHz of a PCS 1900 band might be defined for AT&T, while another MHz band portion of that PCS 1900 band might be defined for Sprint, and so on. That full RF band is then converted to a common digital IF band, which is filtered to define band portions. Then, individual digital signal processing circuitry 77, as shown in Figure 3, for each of the multiple service providers, is operable to process channel information associated with that provider's signals while digitally defining beams simultaneously for each individual service provider.

In contrast, the reference of Ke et al. only provides combining at the RF level. For example, referring to Figure 2, the combining structure 156 combines the signals of a first and second base transceiver station (BTS) as RF signals. Furthermore, the base stations operate in different frequency bands, not a common analog band. For example, as noted in column 3, lines 5-34 of Ke et al., a base station at a CDMA is combined with a base station at a GSM band. Such

combining occurs right at the antenna in the RF band, and not in the digital realm. Thus, the signals are segregated by RF frequencies into different RF frequency bands and not through the use of common digital filtering circuitry, which operates on a digital IF band to define individual digital IF band portions for individual service providers and to simultaneously drive an antenna to define at least one individual beam for each service provider.

The Ke et al. reference does not provide any teaching with respect to defining multiple individual beams for signals of at least two individual service providers in a common analog RF communication frequency band and then converting the signals between the analog RF communication frequency band and a common digital IF band, which represents the signals of the plurality of service providers. In the Final Office Action, on page 3, the Examiner argues that the Ke et al. reference teaches circuitry to convert the signals between a communication signal frequency band and a digital band. It specifically cites the digital signals that are transmitted from the base station to an MSC or PSTN. However, as illustrated in Figure 2 of Ke et al., such digital signals are not a digital IF band that represents the signals of the at least two individual service providers. Rather, because the signals were divided at the antenna in the RF realm, by the time those signals are digitally transmitted in a BTS or PSTN form, they would have already been separated for the individual service providers. As such, in the digital realm, there is no common digital IF band. Accordingly, such a limitation as set forth in claim 1 is also missing from Ke et al.

The Examiner notes in the Final Office Action on page 4 that the filtering circuitry is interpreted as combiners and duplexors. However, those combiners and

duplexors operate at RF frequencies and, thus, would never be understood as digital filtering circuitry by a person of ordinary skill in the art.

Furthermore, with respect to the signal processing circuitry, claim 1 recites that the circuitry is operable to process channel signals associated with the individual digital band portions. As noted above, the elements 112, 114, called out by the Examiner would be operating on signals that are not portions of a common digital IF band, but are specifically dedicated to a single service provider. The elements 154 and 152 set forth by the Examiner as part of the signal processing circuitry are combiner filters that operate at RF and do not process digital signals. As such, the Ke et al. reference fails as a base reference to teach the invention as recited in claim 1. The Ke et al. reference maintains two separate RF communication frequency bands, such as a CDMA band and a GSM band, and provides any combination at a crude RF level right at the antenna, rather than having all the common RF signals associated with the multiple service providers converted in a common digital IF band to be filtered and further processed with DSP to digitally discriminate between the signals of the service providers and to define individual beams for each service provider.

As noted by the Examiner on page 4 on the Final Office Action, the Feuerstein et al. reference is relied upon for the concept of defining multiple individual beams for signals in a communication frequency band. Specifically, the Feuerstein et al. reference is directed to a multi-beam antenna wherein the system switches the beams to a receiver in such a way that the best beams are selected. There is no discussion at all with respect to sharing an antenna among multiple

service providers. As such, there is no teaching of defining multiple, individual beams for signals of at least two individual service providers in a common, analog RF communication frequency band. Furthermore, there is no teaching in Feuerstein et al. regarding converting the common RF communication frequency band to a common digital IF band, which represents the signals of the multiple service providers. The Examiner notes in a single line on page 4 that Feuerstein et al. teaches converting filtering signal processing, but such conversion is simply of individual beams and the processing is switching control to switch to the most desired beam. Accordingly, the Feuerstein et al. reference also fails to teach the present invention alone and, certainly, does not provide additional teaching with respect to the Ke et al. reference such that the combination would render the invention obvious as recited in claim 1. Therefore, claim 1 is allowable over the combination of Ke et al. and Feuerstein et al.

Depending from claim 1, claim 4 has been canceled. The remaining dependent claims 2-3 and 5 and 5-15 are all also allowable over the Ke et al. and Feuerstein et al. references for the reasons noted above.

With respect to claim 2, the Ke et al./ Feuerstein et al. combination of references does not teach converting a common analog RF frequency band containing the signals of multiple service providers to a common intermediate frequency band which also contains the signals of multiple service providers. There is also no teaching to convert the signals to a common digital IF band which also contains the signals of multiple service providers. As such, claim 2 is allowable over the combination of Ke et al. and Feuerstein et al.

Claim 3 also defines over the Ke et al./ Feuerstein et al. combination of references because there is no teaching in either of those references to utilize signal processing circuitry to process channel signals associated with individual digital IF band portions for individual service providers or to define multiple individual beams for each individual service provider. As such, claim 3 is allowable over the combination of Ke et al. and Feuerstein et al.

With respect to claim 5, the Examiner is correct in noting that the Ke et al./ Feuerstein et al. combination of references does not teach an antenna with an array of elements arranged in columns wherein the signal processing circuitry defines the individual beams by individually controlling each of the columns of the array. Figure 2 referred to in Feuerstein et al. only refers to beams 1-12 and does not provide any specific teaching with respect to how the beams are formed. As such, there is no teaching provided to a person of ordinary skill in the art with respect to the limitations of claim 5. As such, claim 5 is allowable over the combination of Ke et al. and Feuerstein et al.

With respect to claim 6, the Examiner refers to Feuerstein et al. and a channel element/controller 26-1, etc. and switch decision controllers 22-1, etc. However, such devices are only for controlling where the best beam signals are routed and are not directed to how the individual beams are defined. Certainly, the reference does not teach individual control of elements of the array. As such, claim 6 is allowable over the combination of Ke et al. and Feuerstein et al.

Similarly, with respect to claim 7, the Examiner notes the silence of the references regarding teaching the limitation, but states that the device takes traffic

channel outputs and routes then simultaneously to the best forward path antenna beams. However, such simultaneous routing of some other signals does not teach signal processing circuitry that defines individual beams simultaneously for multiple service providers. As such, claim 7 is allowable over the combination of Ke et al. and Feuerstein et al.

Claim 8 is rejected over Ke et al./Feuerstein et al. as further modified by Reudink et al. The Examiner refers to Reudink et al. simply for teaching a number of beams that extend into different directions. However, the Reudink et al. reference does not provide the teaching lacking in Ke et al./Feuerstein et al. such that claim 8, which depends from claim 1, would be rendered obvious by that three reference combination. As such, claim 8 is also in an allowable form.

Claim 9 depends from claim 2 and, thus, is allowable for that reason alone. However, as neither Ke et al. nor Feuerstein et al. discloses fiber converters as recited in claim 9 or the claimed digital converter circuitry or the operable signal processing circuitry as recited, this combination cannot render the claim obvious. Thus, claim 9 is also in an allowable form.

As discussed hereinabove, because the Ke et al./Feuerstein et al. combination does not teach the recited circuitry to convert antenna signals between a common analog RF communication frequency band and a common IF digital band, it certainly cannot teach dividing the analog RF communication band into multiple analog RF portions. As such, claim 10 is allowable over the combination of Ke et al. and Feuerstein et al.

With respect to claim 11, the Examiner notes that the Ke et al./Feuerstein et al. combination is silent in dividing the communication frequency band into multiple bands for conversion but argues that it would simply be obvious based upon that same combination. However, as noted above with respect to claim 1, there is no teaching in that combination regarding converter circuitry to convert a common RF communication frequency band into a common digital IF band representing the signals of at least two service providers. Accordingly, claim 11 is also allowable.

Regarding claim 12, as the Ke et al./Feuerstein et al. combination fails to teach an array of elements operable to define individual beams for signals to at least two individual service providers and a common analog RF communication frequency band, such a combination also fails to teach the antenna array that is operable to define multiple individual beams and a plurality of such analog RF communication frequency bands. Accordingly, claim 12 is also allowable over the cited art.

With respect to claim 13, such a claim depends from claim 12 and thus would be allowable for that reason alone and also because it depends from claim 1.

With respect to claim 15, the Examiner goes to the reference of Roberts et al. to combine with Ke et al./Feuerstein et al. to teach that invention. Specifically, the Examiner refers to the Roberts et al. reference for its beam-steering aspects. However, claim 14 depends from claim 1 and, since the Roberts et al. reference fails to teach the elements recited in claim 1 that are not found in the Ke et al./Feuerstein et al. combination, the three reference combination would not render claim 14 obvious. There is no teaching of how a person of ordinary skill in the art would even combine these three very different references to yield the present

invention. It is well established that such a hindsight combination does not establish a *prima facie* case of obviousness. As such, claim 14 is in an allowable form.

Finally, claim 15 depends from claim 14 and, thus would be allowable for that reason alone and also because it depends from claim 1. As noted, the Roberts et al. reference provides no additional teaching of the elements lacking in Ke et al. Feuerstein et al. such that the three reference combination would not render claim 15 obvious. As such, claim 15 is in an allowable form.

Claim 16 recites several of the limitations as recited in claim 1. For example, claim 16 recites the array of elements for each sector antenna is operable to define multiple individual beams for signals of at least two individual service providers in a common, analog RF communication frequency band. Furthermore, claim 16 recites that the converter circuitry converts the antenna signals between the common RF communication band and a common digital IF band. For the reasons noted above with respect to claim 1, the Ke et al. /Feuerstein et al. does not render claim 16 obvious.

Claim 17 depends from claim 16 and thus would be allowable over the Ke et al. / Feuerstein et al. combination for the reasons noted above with respect to claims 1 and 3, and the Ke et al. /Feuerstein et al. does not render claim 17 obvious.

Claim 18 depends from claim 16 and thus would be allowable over the Ke et al. / Feuerstein et al. combination for the reasons noted above with respect to claims 1 and 5, and the Ke et al. /Feuerstein et al. does not render claim 18 obvious.

Claim 19 depends from claim 16 and thus would be allowable over the Ke et al./ Feuerstein et al. combination for the reasons noted above with respect to claims 1 and 6, and the Ke et al. /Feuerstein et al. does not render claim 19 obvious.

Claim 20 depends from claim 16 and thus would be allowable over the Ke et al./ Feuerstein et al. combination for the reasons noted above with respect to claims 1 and 7, and the Ke et al. /Feuerstein et al. does not render claim 20 obvious.

Claim 21 depends from claim 16 and thus would be allowable over the Ke et al./ Feuerstein et al./Reudink et al. combination for the reasons noted above with respect to claims 1 and 8.

Claim 22 depends from claim 16 and thus would be allowable over the Ke et al./ Feuerstein et al. combination for the reasons noted above with respect to claims 1 and 11, and the Ke et al. /Feuerstein et al. does not render claim 22 obvious.

Claim 23 depends from claim 16 and claim 24 depends from claim 23 and thus would be allowable over the Ke et al./ Feuerstein et al./Roberts et al. combination for the reasons noted above with respect to claims 14 and 15.

Claims 25-33 are canceled herein without prejudice.

Claim 16 has been amended to recite a cellular system for accommodating multiple service providers and, thus, would be broad enough to cover a system wherein an RF link is provided, or a microwave backhaul link is provided. As such, claim 16 and its dependent claims are broad enough to cover the system previously set forth with respect to claims 25 and 33. Claims 25-33 may be pursued in a Continuation application.

Turning now to claim 34, that claim recites a method for sharing a cellular tower amongst multiple service providers comprising generating at least one individual beam for a service provider in a first band portion for use through an antenna having an array of elements operable to define multiple, individual beams for signals in at least one analog RF communication frequency band. Claim 34 further recites the step of generating at least one other individual beam for a second service provider in a second band portion of the analog RF communication frequency band. The service providers share the analog RF communication frequency band. Further recited is the step of converting the antenna signals associated with the beams between the analog RF communication frequency band and a digital IF band representing the signals of the first and second service providers. Thus, there is a digital IF band that includes all the signals of the first and second service providers. Claim 34 recites digital filtering of the digital IF band to define individual portions of the digital IF band such that a separate band portion is defined for the first and second service providers. Finally, claim also recites digital signal processing the signals associated with the separate digital IF band portions for the first and second service providers and driving the antenna to define individual beams of the first and second service providers.

As noted above with respect to the Ke et al./Feuerstein et al., the main Ke reference is directed to simply combining RF signals in a somewhat crude fashion right at the antenna. Furthermore, each of the two service providers as set forth in Ke operate in separate frequency bands such as a CDMA band and a GSM band. Therefore, there is no teaching in that cited combination of generating individual

beams for signals of first and second service providers in a common analog RF communication frequency band. Furthermore, there is no teaching of converting such signals between the RF communication frequency band and a digital IF band which also represents the signals of both the first and second service providers as noted above. Since the Ke reference and the Feuerstein reference combined do not teach the first and second service providers existing in a common digital IF band, the combination of references certainly does not teach digital filtering to define separate band portions from the digital IF band for the first and second service providers. Finally, there is no teaching of digital signal processing the signals associated with the separate digital IF band portions for the first and second providers and to drive the antenna to define individual beams of the first and second providers. Accordingly, claim 34 defines over the Ke et al./Feuerstein et al. combination.

Claim 35 depends from claim 34 and thus is allowable for that reason. Furthermore, claim 35 is allowable for the reasons discussed hereinabove with respect to claim 3.

Claim 36 depends from claim 34 and thus is allowable for that reason. Furthermore, claim 35 is allowable for the reasons discussed hereinabove with respect to claim 5.

Claim 37 depends from claim 34 and thus is allowable for that reason. Also, claim 37 is allowable for the reasons discussed hereinabove with respect to claim 6.

Claim 38 depends from claim 34 and thus is allowable for that reason. Furthermore, claim 38 is allowable for the reasons discussed hereinabove with respect to claim 7.

Claim 39 depends from claim 34 and thus is allowable for that reason. Furthermore, claim 39 is allowable for the reasons discussed hereinabove with respect to claim 12.

Claim 40 and 41 depend from claim 34 and thus are allowable for that reason. Furthermore, claim 40 and 41 are allowable for the reasons discussed hereinabove with respect to claims 14 and 15 over the combination of Ke et al./Feuerstein et al. and Roberts.

Claim 42 is cancelled.

Claim 43 depends from claim 34 and thus is allowable for that reason as discussed above with respect to claim 34. The Struhsaker reference that is combined with Ke et al./Feuerstein et al. to reject claim 43 is merely recited with respect to teaching a microwave backhaul frequency band. However, the mere mention of existence of microwave backhaul in the specification of that reference does not in any way provide the teaching lacking in the base Ke et al./Feuerstein et al. combination such that the three reference of Ke et al./Feuerstein et al. and Struhsaker would render obvious claim 43 thus that claim is also allowable.

Claims 44-53 are cancelled herein without prejudice. Such claims directed to sharing a cellular tower among multiple RF link service providers and multiple service providers who require a microwave backhaul applications would be covered

by the claims set forth as claim 34-41 and 43. The claim 44-53 may be pursued in a continuation application.

The claim 54 is also cancelled and may be pursued in a continuation application.

Finally, claim 55 has been amended to include some limitations as set forth with respect to claim 1. Specifically, claim 55 recites an antenna which defines multiple, individual beams for signals of at least two individual service providers in an analog RF communication frequency band. Claim 55 further recites converter circuitry to define a digital IF band from the analog RF communication frequency band and circuitry to duplicate the digital IF band. Finally, claim 55 recites signal processing circuitry for each of the at least two service providers which is operable to process the digital IF band and define individual digital IF band portions corresponding to the service providers and to process signals of the service providers associated with such digital IF band portions and simultaneously drive the antenna to define at least one individual beam for each individual service provider.

As noted above with respect to the Ke et al./Feuerstein et al. combination, there is no teaching of an antenna that defines multiple individual beams of multiple individual service providers in a common analog RF communication frequency band. Nor is there any teaching of converter circuitry to define a digital IF band converter circuitry from the analog RF communication frequency band and circuitry to duplicate the digital IF band. In fact, there is no teaching in the Ke et al./Feuerstein et al. reference combination of even having a common digital IF band in which the

signals of the service providers are found together. Finally, there is no teaching in Ke et al./Feuerstein et al. with respect to signal processing circuitry operable to process the digital IF band and define individual digital IF band portions corresponding to the service providers. As noted above, in the Ke reference when the signals simply get past the antenna, they are separated into different RF bands in the analog realm. By the time they are ever digitized and processed, they are already in separate bands. Thus there is no teaching in Ke et al./Feuerstein et al. of signal processing circuitry operable to process the common digital IF band and define individual IF band portions corresponding to the service providers. Accordingly, claim 55 is also allowable over the Ke et al./Feuerstein et al. combination.


CONCLUSION

Applicants submit that the currently pending claims are in an allowable form and, therefore, requests a Notice of Allowability of the application at the Examiner's earliest convenience. If any issues remain in the case which might be handled in an expedited fashion, such as through a telephone call or an Examiner's Amendment, the Examiner is certainly encouraged to telephone the Applicants' representative or to issue an Examiner's Amendment.

Applicant encloses a check in the amount of \$120.00 for a one-month extension of time to submit a Response herein, and a check in the amount of \$790.00 for filing a Request for Continued Examination. The Applicants know of no additional fees due with this submission. However, if any charges or credits are necessary, please apply them to Deposit Account 23-3000.

Respectfully submitted,

WOOD, HERRON & EVANS, L.L.P.


Kurt A. Summe
Reg. No. 36,023

2700 Carew Tower
Cincinnati OH 45202
(513) 241-2324 (voice)
(513) 421-7269 (facsimile)